M. Sc. in Nutrition and Dietetics
Duration – 2years

Semester-Mode Examination System

Debra Thana Sahid Kshudiram Smriti Mahavidyalaya (Autonomous)

Paschim Medinipur: 721102

M.Sc. (2years Course) in Nutrition and Dietetics

Outline of the syllabus (Semester system)

Total Marks = 1200
Theoretical Marks = 800
Practical Marks = 400
Total Credits= 96

Summary of Courses of Studies: M. Sc. in Nutrition and Dietetics

(Under Choice Based Credit System)

1st Semester			
Course No.	**Core**	**Title**	**Credit Hour**
NUD – 101	(Core)	Physiological Aspects of Nutrition	4 (Theory)
NUD – 102	(Core)	Life Cycle Events & Nutritional Assessment	4 (Theory)
NUD – 103	(Core)	Therapeutic Diet Part I	4 (Theory)
NUD – 104	(Core)	Food Toxicology & Food Safety	4 (Theory)
NUD – 195	(Core)	Therapeutic Diet Formulation- Part I and community Nutrition Survey	4 (Practical)
NUD – 196	(Core)	Nutritional Physiology	4 (Practical)
2nd Semester			
NUD – 201	(CBCS)	Nutrition and Public Health	4 (Theory)
NUD – 202	(Core)	Nutritional Epidemiology and Public Health Nutrition	4 (Theory)
NUD – 203	(Core)	Therapeutic Diet Part II	4 (Theory)
NUD – 204	(Core)	Nutritional Chemistry and Metabolism	4 (Theory)
NUD – 295	(Core)	Therapeutic Diet formulation- Part II	4 (Practical)
NUD – 296	(Core)	Food Analysis	4 (Practical)
3rd Semester			
NUD – 301	(CBCS)	Food Style and Disease Management	4 (Theory)
NUD – 302	(Core)	Bio-statistics, Bio informatics and Computer Application	4 (Theory)
NUD – 303	(Core)	Therapeutic diet Part III	4 (Theory)
NUD – 304	(Core)	Nutraceuticals, Food fortification, Processing & Preservation	4 (Theory)
NUD – 395	(Core)	Therapeutic diet formulation- Part III and Food industry / Research institute Visit	4 (Practical)
NUD – 396	(Core)	Biostatistics, Computer Applications and Review Work	4 (Practical)
4thSemester			
NUD – 401	(Core)	Food Microbiology and Biomolecule separation	4 (Theory)
NUD – 402	(Core)	Nutrition Counseling and Sports Nutrition	4 (Theory)
NUD – 403	(Core)	Research Methodology, Review and Scientific Article writing skill	4 (Theory)
NUD – 404	(Core)	Neutrigenomics, Nutriproteomics and Drug Nutrient Interaction	4 (Theory)
NUD – 495	(Core)	Internship Training in Hospital & Report Preparation (1 month)	4 (Practical)
NUD – 496	(Core)	Project Work	4 (Practical)

SEMESTER - I

M. Sc. in Nutrition and Dietetics

COURSE STRUCTURE

(ME- Major Exam, IA- Internal Assessment)

Course No.	Core	Course Title	ME	IA	Total Marks	Credit
NUD – 101	(Core)	Physiological aspects of Nutrition	40	10	50	4 (Theory)
NUD – 102	(Core)	Life Cycle Events & Nutritional Assessment	40	10	50	4 (Theory)
NUD – 103	(Core)	Therapeutic Diet Part I	40	10	50	4 (Theory)
NUD – 104	(Core)	Food Toxicology & Food Safety	40	10	50	4 (Theory)
NUD – 195	(Core)	Therapeutic Diet Formulation Part I and Community Nutrition Survey	50	-	50	4 (Practical)
NUD – 196	(Core)	Nutritional Physiology	50	-	50	4 (Practical)
TOTAL			300			24

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M.Sc. 1st Semester

Theory

Course No. NUD – 101: Physiological Aspects of Nutrition **4 Credits**

Group- A **2 Credits**

- **1.1:** Digestive system: Organs of the digestive system, Secretary, digestive and absorptive functions of GIT, Pancreas, Liver, Gall bladder. Motility and hormones of GIT. Digestion and absorption of carbohydrate, protein and lipid. Stress and digestive diseases, General concept of digestive diseases- causes and symptoms. Role of transporter in absorption.
- **1.2:** Excretory system: Structure and function of kidney, formation, composition, and excretion of urine. Role of kidney in water, electrolytes and acid base balance. Renal disease- causes and symptoms.
- **1.3**: Respiratory system: Regulation of respiration exchange of gases, transport of oxygen and carbon dioxide. Role of Hb and buffer system, Disorders of respiratory system- acid-base imbalance. Malnutrition and respiratory disorders.
- **1.4:** Cardiovascular System: Physiology of heart, Cardiac cycle, cardiac output, Functions of CVS, Regulation of cardiac output and blood pressure, ECG, Blood pressure, Disorders of heart. Stress and CVD. Nutrients and cardiac health.
- **1.5:** Reproductive System: Physiology of female reproductive system- External and internal organs- puberty in the female, Menstrual cycle, menopause, Physiology of Male Reproductivesystem- External and internal organs, Functions of male reproductive system. Stress and reproduction. General concept of infertility. Endometriosis, PCOS. Diet and fertility.

Group- B **2 Credits**

- **2.1:** Immune system: Properties, natural and acquired Immunity, features of immune responses, antigen – antibodies – types, properties, antigen – antibody interaction, B – and T – cell biology, MHC, Autoimmune disorders, hypersensitivityand allergy, Immunization, Nutritional immunology, Different approaches of vaccination development. Immuno-boosting and immunomodulating foods.
- **2.2:** Muscular System**:** Structure and functions of muscles, Diseases of muscles, Muscle mass and Physical Activity, Nutrients on muscle mass, Muscle cramps, Muscle fatigue and role of nutrients, Energy source of muscle in different activities- Creatin Phosphate System, Glycogen loading in muscle.
- **2.3:** Nervous System**:** Central nervous system- structure and functions of brain and spinal cord; Peripheral Nervous system- spinal nerves and cranial nerves; Autonomic nervous system; Neurons. Concept of Neural Diseases, Enteric Nervous System, Nutrient for Neural Activity Maintenance.

- **2.4:** Sense Organs: Structure and functions of ear, eye, skin, nose, physiology of smell, Sense of taste.
- **2.5:** Endocrine System: Structure and functions of Pituitary gland and Hypothalamus, Thyroid gland, Parathyroid gland, Adrenal and Suprarenal glands, Pancreatic islets, Pineal body, Thymus gland, local hormones, Disorders of Endocrine glands in brief. Role of ANH, Signal transduction process by hormone through receptor- Genomic and nongenomic signaling processes. CAMP, GMP, Tyrosine kinase, MAPK, DG & IP3 signaling systems.
- **2.6:** Aesthetic Aspect of Nutrition: Aesthetic importance of food, Impact of neural reflex on proper nutrition.

Course No. NUD – 102: Life Cycle Events and Nutritional Assessment 4 Credits

Group- A 2 Credits

- **1.1:** Food Groups and Recommended Allowances- Different food groups and planning diets to meet the requirement at different socioeconomic levels, Recommended allowances for Indians, Basics requirement for computation of the allowances (comparison of India's recommended allowances with that of UK, USA, FAO & WHO),
- **1.2:** Nutrition in Pregnancy and Lactation- Nutritional status and general health, weight gain during pregnancy and nature of weight gain, requirements, storage of nutrients in normal pregnancy. Physiological cost, complications fetal growth and implications of public health programmes. Nutritional requirements of lactation.
- **1.3:** Nutrition in infancy- Nutritional status of infants, weight as the indicator, Nutritional allowance for the infants, breast feeding, breast feeding versus formula feeding, weaning foods suitable for infants, feeding the premature infant
- **1.4:** Nutrition in Preschool- Prevalence of malnutrition in preschool age, food habits and nutrient intake of preschool children, dietary allowances – supplementary foods, feeding programms for preschool children.
- **1.5:** Nutrition during school age- Physical development – Nutritional status of school age children, school lunch programmes, food habits, nutritional requirements for school age children.
- **1.6:** Nutrition during adolescence- Change of growth, characteristics of adolescents, nutritional needs of the adolescents, changes needed to prevent malnutrition in adolescence.
- **1.7:** Nutrition for Adults- Nutrition for the adults, basis for requirement of nutrients and work efficiency.
- **1.8:** Nutrition for the Aged- Nutritional requirements for aged, socio economic and psychological factors, Clinical needs, malnutrition of elderly persons

Group- B 2 Credits

- **2.1:** Human growth and development, Uterine and neonatal growth, Skeletal and muscular growths.
- **2.2:** Reproductive growth and development and its determinants.
- **2.3:** Impact of altered nutrition on growth and development, Changes in Body composition throughout the life cycle, Alterations in body composition and their consequences.
- **2.4:** Principle of Nutritional status by anthropometric assessment – advantages and disadvantages, Different Anthropometric measures and their importance in nutritional status. Anthropometry – methods, reference standards in children and adults, scales of comparison (percentiles, Z score) classification and interpretation of somatic data, somatic indicators of PEM. Contactless anthropometry.

- **2.5:** Age group specific height, weight, weight for age, weight for height, BMI. Indian reference value, process- limitation.
- **2.6:** Body fat determination - process and its impact on nutritional anthropometry, Body mass determination.
- **2.7:** Determination of BMR.
- **2.8:** Bio-chemical Assessment- Sensor, criteria, relation with nutritional status, critical or risk level, Upper border and lower border
- **2.9**: Vital Statistics –Definition and importance, MR types, OR, IR, PR (Prevalence Rate)

Course No. NUD – 103: Therapeutic Diet Part I **4 Credits**

Group- A **2 Credits**

- **1.1:** Energy calculation- Normal and pathophysiological condition. Energy expenditure, REE, AER, RDA, BMR.
- **1.2:** Principle of diet formulation and its different steps- Factors affecting nutrient requirement (genetic, stage of life, nutrient interactions, environmental impacts, microbiological status, research condition). Types of diet formulation- natural-ingredient diets (nutrient concentrations, fixed-formula diet), purified and chemically defined diets.
- **1.3:** Special features of therapeutic diet and its formulation. Characteristics of therapeutic diet, purpose of therapeutic diet, principle of therapeutic diet, classification of therapeutic diet. Different special types of therapeutic diet.
- **1.4:** Way of nutrition care- Oral feeding, enteral feeding, parenteral feeding including partial and total parenteral feeding- their purpose, types, indications, merits, demerits, conditions for application.
- **1.5:** Polymeric and Monomeric formulated diet. F-75 and F-100 – composition, condition of application.

Group- B **2 Credits**

- **2.1:** Group based and subject based therapeutic diet (personalized diet) and their advantages.
- **2.2:** Assessment of therapeutic diet in general.
- **2.3:** Dietary management of febrile condition- Development of fever, types of fever. Dietary management of acute and chronic fever.
- **2.4**: Severe Acute Malnutrition- Definition, etiology, pathophysiology, complications, principle of diet, Clinical dietary management. Refeeding syndrome- definition, clinical manifestation, management.
- **2.5:** Critically ill children- Different types of critically ill child, Metabolic response to critical illness- protein metabolism, carbohydrate metabolism, energy metabolism, electrolyte metabolism, vitamin and mineral metabolism. Nutrition in critical illness- enteral nutrition (purpose, initiation, route of feeding, advantages, drawbacks), parenteral nutrition (purpose, initiation, route of feeding, advantages, drawbacks).

Course No. NUD – 104: Food Toxicology and Food Safety 4 Credits

Group- A 2 Credits

- **1.1:** Concept and meaning of food quality and food safety, food adulteration, food hazards. Natural toxins.
- **1.2:** Exposure, estimation, toxicological requirements and risk assessment.
- **1.3:** Safety aspects of water and beverages such as soft drinks, tea, coffee, cocoa.
- **1.4:** Toxicity Indicators of food- LD 50, ED 50, safety factors of toxicity
- **1.5:** Mode of food toxicants on health disorders- Neural, Cardiac, Gastro intestinal, Carcinogenic, Skeleto-muscular.
- **1.6:** Food packaging- Basic idea, classification, advantages. Nano sensor-based packaging, Modified air packaging, Paper packaging, Plastic packaging, Flexible packaging, Cartoon packaging.

Group- B 2 Credits

- **2.1:** General definition- cleanliness, hygiene, sanitation. General principles of food hygiene, hygiene in rural and urban areas in relation to food preparation. Personal hygiene and food handling habits. Importance of sanitation and hygiene in food services.
- **2.2:** Sanitary aspects of water supply, source of water, quality of water, water supply and its uses in food industries. Purification and disinfection of water prevention contamination of potable water supply.
- **2.3:** Effective detergency and cleaning practices: Importance of cleaning technology, physical and chemical factors in cleaning, classification and formulation of detergents and sanitizers, cleaning practices. Sanitary aspects of waste disposal, establishing and maintaining sanitary practices in food plants, role of sanitation, general sanitary consideration and sanitary evaluation of food plants.
- **2.4:** Good manufacturing practice for food sector- in food industry, at household level. Extraneous materials in foods, principles of insects and pet control. Physical and chemical control. Effective control of microorganism: Importance of microorganism in food sanitation. Microorganism as indicator of sanitary quality. Hygiene and sanitation practices in food operating industry- before production, during production, after production
- **2.5:** Safety assessment of food contaminants and pesticide residues. Safety evaluation of heat treatments and related processing techniques.
- **2.6:** Food laws and regulations – national and international food laws, governing bodies, importance of food laws, Indian standards for food laws (BIS, DMI/ AGMARK, FSSAI), PFA act, FPO.

Practical

Course No. NUD – 195: Therapeutic Diet Formulation Part I and Community Nutrition Survey
4 Credits

Therapeutic Diet Formulation

- **1.1:** F-75, F-100 diet formulation
- **1.2:** Diet for adult male, female (According to different physical activity)
- **1.3:** Diet for pregnant mother (according to trimester with meal frequency)
- **1.4:** Diet for lactating mother
- **1.5:** Weaning food formulation
- **1.6:** Diet for preschool children
- **1.7**: Diet for school children
- **1**.8: Diet for adolescent

Nutritional Survey

The students should participate in a nutritional survey in the community and submit a report during examination. The Survey may be made on the following topics:

- **1.9:** Determination of socioeconomic status
- **1.10:** Determination of energy requirement of sedentary, moderate and heavy workers (Male & Female)
- **1.11:** Determination of nutritional consumption by questionnaire method
- **1.12:** Determination of nutritional status by weighing method / cooked food method
- **1.13:** Study on nutritional status of the beneficiaries under National nutritional Program

Course No. NUD – 196: Nutritional Physiology **4 Credits**

Nutritional Physiology

- **1.1:** Macro nutrient analysis in blood – Carbohydrate- fasting and Post Prandial, Protein- albumin, globulin, Fat- total cholesterol & lipid profile (HDL, LDL, VLDL, Triglycerides)
- **1.2**: Micro nutrient analysis in blood – Vitamin- Vit A, Vit C, Minerals
- **1.4:** Qualitative determination of nutraceuticals

Nutritional Anthropometry

- **1.5:** Nutritional status of Pre-school children using anthropometric parameters.
- **1.6:** Nutritional status of school going children using anthropometric parameters
- **1.7:** Nutritional status of adolescence using anthropometric parameters.
- **1.8:** Nutritional status of geriatric person.

(Above nutritional assessments should be made by measuring height, weight, head circumference, Mid-arm circumference, BMI and other anthropometric indices and skin fold thicknesses)

SEMESTER - II

M. Sc. in Nutrition and Dietetics

COURSE STRUCTURE

(ME- Major Exam, IA- Internal Assessment)

Course No.	Core	Course Title	ME	IA	Total Marks	Credit
NUD – 201	(CBCS)	Nutrition and Public Health	40	10	50	4 (Theory)
NUD – 202	(Core)	Nutritional Epidemiology and Public Health Nutrition	40	10	50	4 (Theory)
NUD – 203	(Core)	Therapeutic Diet Part II	40	10	50	4 (Theory)
.NUD – 204	(Core)	Nutritional Chemistry and Metabolism	40	10	50	4 (Theory)
NUD – 295	(Core)	Therapeutic Diet Formulation Part II	50	-	50	4 (Practical)
NUD – 296	(Core)	Food Analysis	50	-	50	4 (Practical)
TOTAL			**300**			**24**

M. Sc. 2nd Semester

Theory

Course No. NUD –201 (CBCS): Nutrition and Public Health **4 Credits**

Group-A **2 Credits**

- **1.1:** Basic information on Nutrition-Nutrition, Nutrients, Nutritional status, Health, Determinants of health, Interrelationship between nutrition and health, Malnutrition, Different types of malnutrition.
- **1.2:** Role of carbohydrate, protein, fat, vitamins, minerals, dietary fiber in health maintenance
- **1.3:** Disproportionate intake of nutrients and its health impact (Undernutrition, Anemia, Vitamin A deficiency, Vitamin D deficiency)
- **1.4:** Food groups, Food pyramid, Food exchange list
- **1.5:** Fast food, Junk food, Packaged food, Free food- definition, advantages, disadvantages, impact on health.
- **1.5:** Food contamination- sources, factors. Food hygiene- major public health issues in food hygiene, causes of food borne illness, Food safety, HACCP.

Group-B **2 Credits**

- **2.1:** Immunization schedule- Vaccination, immunization, importance of vaccination, immunization schedule runs in India.
- **2.2:** Food Laws, Act- importance of food laws, Indian standards for food laws (BIS, DMI/ AGMARK, FSSAI), PFA act, FPO.
- **2.3:** Public health and hygiene- concept of public health, different domains of public health, strategies for public health. Concept of hygiene, relation between hygiene and sanitation.
- **2.4:** Protein deficiency and impact on public health- Causes of protein deficiency, classification of protein deficiency, prevention and management for protein deficiency.
- **2.5:** Carbohydrate deficiency impact on public health- Causes of carbohydrate deficiency, different types of carbohydrate deficiency, prevention and management for carbohydrate deficiency,
- **2.6:** Public health programs- importance of public health program, national programs for communicable diseases (TB, AIDS, leprosy, Immunization), national programs for noncommunicable diseases (blindness, cancer, diabetes, CVD), national nutritional programs (ICDS, MDM, SNP, Anemia, Iodine).
- **2.7:** Family welfare- objectives, family planning-importance, methods of contraception, importance of family welfare program.
- **2.**8: Mother child health care – ANC, INC, PNC, breastfeeding and weaning.

Course No. NUD –202: Nutritional Epidemiology and Public Health Nutrition 4 Credits

Group-A **2 Credits**

- **1.1:** Definition and concepts of epidemiology- DALYs, QALYs, incidence rate, prevalence rate, screening test, true positive, true negative, false Positive, false negative, diagnostic test, ratio, rate, disease transmission, OR.
- **1.2:** Types of epidemiology and uses of epidemiology. Nutritional epidemiology and common determinants
- **1.3:** Role of genetics on health and disease- special reference of inborn error metabolism, thalassemia, hemophilia, leukemia, color blindness and their prevention.
- **1.4:** Levels of disease prevention- primordial, primary, secondary, tertiary.
- **1.5:** Important Public Health Acts- Pre conception and parental diagnostic act, The maternity benefit Act, Epidemic disease act, Vaccination act, Water pollution act.
- **1.6:** Health problems of developed and developing countries
- **1.7:** Nutritional epidemiology- components, determinants, pandemic, endemic, epidemic

Group-B **2 Credits**

- **2.1**: Population growth- Process of population change, definition of population growth, factors affecting population growth, problems on population growth, solutions to problems of population growth.
- **2.2**: Birth rates, death rates, fertility rates, age-specific mortality rates, MMR, CPR, etc.
- **2.3:** Immunization Schedule- Definition of immunization, vaccine. Types of vaccine- live attenuated, inactivated, toxoids. Cold chain- definition, importance, equipment, Importance of immunization, immunization coverage. Immunization schedule in India.
- **2.3:** Approaches and methods of contraception- classification of contraceptive methods- spacing methods (barrier methods, vaginal methods, intrauterine devices, hormonal methods, non-hormonal contraceptive pills, post-coital contraception, fertility awareness-based methods, LAM) terminal/ permanent methods (vasectomy, tubectomy), advantages, side effects, contraindications and complications of different contraceptive methods.
- **2.4:** Family welfare and planning, Mother Child Health care and its components.
- **2.5:** Communicable and non-communicable diseases- infectious and contagious diseases.
- **2.6:** Occupational disorders like, pneumoconiosis, hearing loss, accidents, dermatosis, asbestosis, silicosis etc.
- **2.7:** Major nutritional problems (PEM, Micronutrient deficiency, Chronic diseases, Eating disorders)- at risk group, etiology, clinical manifestations

and prevention.

- **2.8:** RCH program- Components of RCH care, Need and package of services under RCH Program, Health Programs.
- **2.9:** Nutrition Communication on public health upgradation- Principle, types, techniques, rural based nutrition communication, emphasis on KAP study, community-based nutrition Program.
- **2.10:** Supplementary Nutrition Program- Major programs, objectives, operation and public health upgradation.

Course No. NUD -203: Therapeutic Diet Part II **4 Credits**

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Group-A **2 Credits**

- **1.1:** Therapeutic diet for diabetes mellitus- Complications, causes, symptoms, diagnostic test, strategy for carbohydrate, protein, fat, dietary fiber, nutraceuticals, minerals, resistance starch inclusion, principle, management of diabetes by clinical diet. Role of functional food in management of diabetes.
- **1.2:** Clinical diet for atherosclerosis – Complications, causes, symptoms, diagnostic test, risk factors (unmodifiable, modifiable, novel), strategy for carbohydrate, protein, fat, dietary fiber, nutraceuticals, minerals, resistance starch inclusion or exclusion. Role of functional food for atherosclerosis. Principle of diet, nutritional management and dietary guidelines.
- **1.3:** Therapeutic diet for hypertension- Complications, causes, symptoms, diagnostic test, strategy for carbohydrate, protein, fat, dietary fiber, nutraceuticals, minerals, resistance starch inclusion or exclusion. management of hypertension by DASH diet. Role of probiotics and functional food in management of hypertension.
- **1.4:** Therapeutic diet for hyperlipidemia- Complications, causes, symptoms, diagnostic test, strategy for carbohydrate, protein, fat, dietary fiber, nutraceuticals, minerals, resistance starch inclusion or exclusion. Principle of diet, recommended diets- The Lifestyle Change diet, American Heart Association diet, DASH diet, Mediterranean diet, Ornish diet. Role of probiotics and functional food in management of hyperlipidemia.

Group-B **2 Credits**

- **2.1:** Clinical diet formulation for renal stone, glomerulonephritis, renal failure- complications, causes, symptoms, diagnostic test, strategy for carbohydrate, protein, fat, dietary fiber, nutraceuticals, minerals, resistance starch inclusion and exclusion, dietary management.
- **2.2:** Clinical diet for IBS, IBD, constipation, Peptic Ulcer - symptoms, complications, diagnostic test, causes, strategy for carbohydrate, protein, fat, dietary fiber, nutraceuticals, minerals, resistance starch inclusion and exclusion, dietary management.
- **2.3:** Therapeutic diet for aged person- physiological and psychological changes, significance of proper nutrition in old age, nutrition related problems, food pyramid for older adults, dietary management.
- **2.4:** Therapeutic diet for obesity- symptoms, diagnostic test, complications, types, causes, strategy for carbohydrate, protein, fat, dietary fiber, nutraceuticals, minerals, resistance starch inclusion and exclusion, relationship between physical activity and obesity, dietary management of obesity (different types of diet plan for obesity).

Course No. NUD – 204: Nutritional Chemistry and Metabolism 4 Credits

Group-A 2 Credits

- **1.1:** Carbohydrates: classification and sources of dietary carbohydrates – free sugars, starch, non-starch polysaccharides-, functions of carbohydrates, carbohydrate content of foods, requirements and intakes of dietary carbohydrates, Glycemic index, glycemic load, isomeric structure of carbohydrate, glycosidic bonds and its type. Carbohydrate pool in our body.
- **1.2:** Proteins: Chemistry of proteins, classification and functions of Proteins, Protein turnover, Protein requirements, conformation and structure of proteins – primary, secondary, tertiary and quaternary structure. Amino acids types. First class protein, second class protein. Protein pool in our body.
- **1.3:** Lipids: Types of natural lipids and their functions- structural lipids, storage lipids and metabolic lipids,fats in various foods, composition of fats in diets, chemical properties and characterization of fats. Waxes, Cerebrosides, Gangliosides, Phospholipids and Proteolipids. Steroids and Bile salts, EFA, ester bonds, short chain and medium chain fatty acids, trans fat, PUFA, MUFA. Lipid pool in our body.
- **1.4:** Nucleic Acid: Types of Nucleic Acid and their functions, structure of Nucleic Acid, classification of Nucleic Acid, phosphorylated bonds in nucleic acid, biosynthesis and degradation of purines and pyrimidines and their regulation. Inherited disordersof purine and pyrimidine metabolism.
- **1.5:** Enzymology: Nomenclature and classification, basic structure; basic structure; general properties, coenzymes and their functions, factors influencing enzyme reaction – kinetic properties, Michaelis constant, inhibition, purification, isoenzyme, mechanism of enzyme action, two-substrate reaction mechanism, allosteric and feed-back inhibition, Cofactor, apoenzyme, holoenzyme, amylase inhibitors, lipase inhibitors, protease inhibitors in food items, competitive, non-competitive, uncompetitive inhibition.

Group-B 2 Credits

- **2.1:** Metabolism: Catabolism, anabolism, catabolic, anabolic and amphibolic pathways. amphibolism.
- **2.2:** Energy: Body composition, Physiological fuel value, Gross fuel value, Measurement of energy expenditure- BMR, RMR, TEF, SDA, RDA, ARE, AEE, Estimation of energy requirements for individual and groups, application of RDA, EEE, Age specific RDA.
- **2.3:** Metabolism of Carbohydrates: Glycolysis, TCA cycle, HMP shunt, Bioenergetics, Glycogenolysis, Alcoholic fermentation, Neoglucogenesis – special reference to rate limiting steps, hormonal regulation of blood glucose.
- **2.4:** Protein and Amino acid metabolism: Protein degradation, metabolism of aromatic, sulfur containing, BCAA and other amino acids, fate of nitrogen (Urea cycle), glutamine and alanine cycle, protein biosynthesis.
- **2.5:** Lipid metabolism: Beta – oxidations of saturated fatty acids. Biosynthesis of fatty acids – Acetyl-CoAcarboxylase reaction, Biosynthesis of triglycerides, cholesterol & phospholipids, Regulation of fatty acid biosynthesis, Ketosis.
- **2.6:** Nucleic acid, DNA structure replication, transcription.

- **2.7:** Metabolism of Iron, Zinc, Iodine, Selenium, Fluoride, Chromium, Other essential trace elements.
- **2.8:** Immuno-boosting nutrients and their mode of action- Vitamin A, D, C, B_{12}, Minerals -Zn
- **2.9:** Importance of nutraceuticals- concept, type and health benefit.

Practical

Course No. NUD – 295: Therapeutic Diet Formulation Part II **4 Credits**

- 1.1: Preparation of diet chart for diabetes mellitus
- 1.2: Preparation of diet chart for Hypertension
- 1.3: Preparation of diet chart for Atherosclerosis
- 1.4: Preparation of diet chart for Hyperlipidemia
- 1.5: Preparation of diet chart for Renal stone
- 1.6: Preparation of diet chart for Glomerulonephritis
- 1.7: Preparation of diet chart for renal failure
- 1.8: Preparation of diet chart for IBS, IBD
- 1.9: Preparation of diet chart for constipation
- 1.10: Preparation of diet chart for Diarrhoea
- 1.11: Preparation of diet chart for Dysentery
- 1.12: Preparation of diet chart for cholera
- 1.13: Preparation of diet chart for aged individual

Course No. NUD-296: Food Analysis **4 Credits**

- 1.1: Determination of Saponification Number.
- 1.2: Determination of Acid Number and iodine number
- 1.3: Estimation of Serum cholesterol, triglyceride.
- 1.4: Estimation of Blood glucose by Glucose oxidase / Nelson Somogy method
- 1.5: Estimation of Serum proteins by Biuret method / Lowry method.
- 1.6: Estimation of Albumin / globulin ratio by Biuret method
- 1.7: Estimation of starch from wheat flour
- 1.8: Estimation of lactose from milk
- 1.10: Bio chemical testing of food additives
- 1.11: Estimation of carbohydrate in food
- 1.12: Estimation of dietary fiber
- 1.13: Estimation of Protein (TP)
- 1.14: Estimation of neutral fat and total cholesterol
- 1.15: Estimation of calcium in food
- 1.16: Estimation of phosphorus in food
- 1.17: Estimation of iron in food
- 1.18: Estimation of ascorbic acid in food
- 1.19: Estimation of thiamine in food
- 1.20: Qualitative assessment of nutraceutical

SEMESTER - III

M. Sc. in Nutrition and Dietetics

COURSE STRUCTURE

(ME- Major Exam, IA- Internal Assessment)

Course No.	Core	Course Title	ME	IA	Total Marks	Credit
NUD – 301	(CBCS)	Food Style and Disease Management	40	10	50	4 (Theory)
NUD – 302	(Core)	Bio-statistics, Bio informatics and Computer Application	40	10	50	4 (Theory)
NUD – 303	(Core)	Therapeutic Diet Part III	40	10	50	4 (Theory)
.NUD – 304	(Core)	Nutraceuticals, Food fortification, Processing & Preservation	40	10	50	4 (Theory)
NUD – 395	(Core)	Therapeutic diet formulation- Part III and Food industry / Research institute Visit	50	-	50	4 (Practical)
NUD – 396	(Core)	Biostatistics, Computer Applications and Review Work	50	-	50	4 (Practical)
TOTAL			**300**			**24**

M. Sc. 3rd SEMESTER

THEORY

Course No. NUD – 301 (CBCS): Food style and disease management 4 Credits

Group-A: 2 Credits

1.1. Concept of food style, Healthy food style and its determining factors, Unhealthy food style, Component of healthy food style

1.2. Healthy food style and its beneficial effects in general.

1.3. Nutrition education communication for healthy food style in community.

Group B: 2 credits

2.1 . Diabetes management and food style in general.
2.2 . Cardio vascular management including hypertension and food style in general.
2.3 . Renal Disease management and food style in general.
2.4 . Hepatic disease management and food style in general.
2.5 . Diarrhoea disease management and food style in general.
2.6 . Cancer disease management and food style in general.

Course No. NUD -302: Biostatistics, Bioinformatics and Computer Application 4 Credits

Group-A 2Credits

- **1.1:** Presentation of data: Frequency distribution, bar and pie diagrams, Frequency polygon, histogram, Scattergram
- **1.2:** Statistics of dispersion: range, mean deviation, standard deviation and error, variance
- **1.3:** Characteristics of distributions: probability distribution, normal distribution, skewness, kurtosis
- **1.4:** Mean, median, mode and percentile and percentile rank
- **1.5:** Testing hypotheses: Null Hypothesis, levels of significance, error of inference and estimation of Z scores
- **1.6:** Parametric tests of difference between means: t test, ANOVA including F-Test and post hoc analysis of significance
- **1.7:** Non-parametric tests: Mann Whitney test, Chi square test
- **1.8:** Correlation and Regression

Group B:

- **2.1**. Basic Bioinformatics – Introduction to bioinformatics, its importance and scope, Biological databases,primary and secondary sequence databases,
- **2.2**. Current advancements in bioinformatics: Introduction to System Biology, Structural Biology, Structural bioinformatics, Chemoinformatics, Immunoinformatics etc.
- **2.3.**Sequence analysis: Scoring matrices: basic concept of a scoring matrix, PAM and BLOSUM series. Sequence-based Database Searches: what are sequence-based database searches, BLAST and FASTA algorithms, various versions of BLAST and FASTA.
- 2.4. Word processing and data management: MSWord, MS excel and nutritional data management, MS PowerPoint – its application
- 2.5.Concept of internet – components, uses. WWW, browsing, Searching nutritional information / data, downloading and uploading through internet, application in nutrition

Course No. NUD -303: Therapeutic Diet Part -III

Group-A **2 Credits**

- **1.1:** Hepatitis: causes, sign and symptoms, complications and dietary management.
- **1.2:** Diarrhea: causes, sign and symptoms, complications and dietary management.
- **1.3:** PCOD: causes, sign and symptoms, complications and dietary management.
- **1.4:** Tuberculosis: causes, sign and symptoms, complications and dietary management.
- **1.5.** Anemia: causes, sign and symptoms, complications and dietary management.
- **1.6.** Thalassemia: causes, sign and symptoms, complications and dietary management.
- **1.7.** Neural Degenerative disease: causes, sign and symptoms, complications and dietary management of Alzheimer's disease, Perkinson's disease, ADHD.

Group-B **2 Credits**

- **2.1: Inborn Error of Metabolism -** Description, cause, Dietary management of PKU, Galactosemia, Maple syrup Urinary Disease, Lactose Intolerance.
  2.2: Burn: 9 rules of burn, different formula of energy calculation of burn patients, EVV phase and Flow phase of Burn patients, critical care, dietary management by nutrition care- F100, F75 solution.
- **2.3: Sepsis:** Different formula of energy calculation of sepsis patients, EVV phase and Flow phase of Burn patients, critical care, dietary management by nutrition care- F100, F75 solution.
- **2.5: Trauma:** Different formula of energy calculation of trauma patients, EVV phase and Flow phase of Burn patients, critical care, dietary management by nutrition care- F100, F75 solution.
- **2.6: Cancer:** Different formula of energy calculation of cancer patients, EVV phase and Flow phase of Burn patients, critical care, dietary management by nutrition care- F100, F75solution.

Course NUD -304 : Nutraceuticals, Food fortification, Processing and Preservation. 4 Credit

Group-A 2 Credits

- **1.1:** Nutraceuticals: a) Use of neutraceuticals in traditional health sciences. Their role in preventing / controlling diseases. B) Definition, classification, food and non food sources, mechanism of action, dietary fiber.
- **1.2:** Functional foods: Definition, development of functional foods, benefits and sources of functional foods in Indian diet. Effects of processing conditions and storage. Development of biomarkers to indicate efficacy of functional ingredients.
- **1.3:** Development of nutraceutical and functional foods – standards for health claims. Process of developing – preclinical and clinical studies, marketing and regulatory issues.
- **1.4:** Other food components with potential health benefits: polyphenols: flavonoids, catechins is flavones tanning. Phytoesterogens, Phytosterols, Glucosinolates, Role of Omega-3 & Omega-6 faty acids Pigments: Lycopene, carotenoids, Curcumin etc. Organosulphur compounds, other components – Phytates, Protcase inhibitors, amylase inhibitions, saponins, hemagglutinins.
- **1.**5. Active biodynamic principles of spices, condiments and other plant materials.

Group-B 2 Credits

- **2.1**: Food Fortification**:** Definition, Types, process and importance of Food fortification through gene modification-Golden rice, Vit A fortification, Iron fortification**.**
- **2.2.** Basic principles of food processing and preservation, Processing technology of foods and nutritional implications for cereals and pulses, fruits and vegetables, milk & products meat, fish & egg.
- **2.3:** A. Classification of food in relation to shelf life-Spoilage in food and its control: spoilage Caused by microorganism (bacteria, fungi and virus), enzymes, pets and rodents. B. Food dehydration and concentration: methods of drying and concentration, types of dryers, factors affecting drying process.
- **2.3:** Thermal processing- principle, mechanism and application of sterilization, pasteurization, blanching, canning, drying.
- **2.4:** Non thermal processing: Refrigeration, freezing, freeze drying, refrigerated gas storage, Food irradiation: technology, application and safety assessments, Chemicals in food preservation, safety of preserved foods.
- **2.5:** Food Biotechnology: Membrane technology (reverse osmosis and ultra filtration), agglomeration, agitation, extrusion, b) Enzyme Technology - Production of enzymes - Amylase, Protease, Lipase, Lactase and pectinase, Use of enzymes in food and beverage industry (e.g., Cheese, fruit, juice, Wine, Meat tenderizing and dairy).

Practical

Course No. NUD – 395: Therapeutic Diet Formulation Part-III & Food industry / Research Institute visit

Group A: **4 Credits**

- Diet formulation of Burn
- Diet formulation of Diarrhoea
- Diet formulation of Inborn Error of Metabolism
- Diet formulation of Hepatitis
- Diet formulation of Cancer
- Diet formulation of anemia
- Diet formulation of PCOD

Group B:

Food industry / Research Institute visit

Course. NUD -396: Biostatistics , Computer Applications and Review work **4 Credits**

- **Biostatistics , Computer Applications-**

- Computation of mean, median and mode of grouped and ungrouped data
- Data representation by, bar diagram, histogram and pie diagram
- Computation of standard deviation and standard error of mean
- Students t-test – a) for independent group b) paired group
- Chi square test
- Computation of correlation coefficient
- Computation of one ANOVA
- computer application in Nutrition and Dietetics
- Formulation Bar diagram, Pie diagram, Line diagram from the supplied data using MS Excel.
- Analysis of nutritional data using computer – use of software packages.
- Use of MS Word – data representation in tabular form, manipulation of tables
- Use of MS Excel – data tabulation, data representation by charts
- Statistical analysis of data by MS Excel
- Use of MS power point

- **Review work**- Submission of report on Review Work.

SEMESTER - IV

M. Sc. in Nutrition and Dietetics

COURSE STRUCTURE

(ME- Major Exam, IA- Internal Assessment)

Course No.	Core	Course Title	ME	IA	Total Marks	Credit
NUD – 401	(Core)	Food Microbiology and Biomolecule separation	40	10	50	4 (Theory)
NUD – 402	(Core)	Nutrition Counseling and Sports Nutrition	40	10	50	4 (Theory)
NUD – 403	(Core)	Research Methodology, Review and Scientific Article writing skill	40	10	50	4 (Theory)
.NUD – 404	(Core)	Neutrigenomics, Nutriproteomics and Drug Nutrient Interaction	40	10	50	4 (Theory)
NUD – 495	(Core)	Internship Training in Hospital & Report Preparation (1 month)	50	-	50	4 (Practical)
NUD – 496	(Core)	Project Work	50	-	50	4 (Practical)
TOTAL			**300**			**24**

M.Sc. 4th SEMESTER

THEORY

Course No. NUD – 401 : Food Microbiology and Biomolecule Separation 4 Credits

Group-A **2 Credits**

1.1. Importance of microorganisms in food – cultivation of microorganism and factors affecting the growth of microorganisms in food - intrinsic and extrinsic parameters that affect microbial growth.

1.2. **Contamination and spoilage**:

- Cereal, pulses and their processed products.
- Vegetables and fruits and their products
- Flesh foods, eggs and poultry, milk and milk products

1.3. Fermentation Technology: Types, Application, Health benefits of fermented food products.

1.4. Prebiotics, Probiotics, Symbiotics, Psychobiotics, Gut-Brain system.

Group-B **2 Credits**

- **2.1: Chromatography: P**rinciple, types, techniques, uses- of column chromatography, TLC, GLC, HPLC, Iron exchange.
- **2.2: Electrophoresis: P**rinciple, types, techniques, uses- of Paper, SDS-PAGE, capillary, Iso-electric focusing, Agarose gel electrophoresis. Electrophoretic mobility (EPM)
- **2.3: Centrifugation: P**rinciple, types, techniques, uses- of Centrifugation, Ultra centrifugation.
- **2.4. Bio molecule Immunoassay Technique-** Quantification of molecules using ELISA, RIA, Western Blot, immunoprecipitation, Southern Blot.
- **2.**5. **Immuno cytochemical Technique**: FACS, FRAP. In situ localization: FISH and GISH, flow Cytometry and immunofluorescence microscopy.
- **2.6: Spectrophotometer:** Principle, types, techniques, uses- of UV Spectrophotometer, Infrared Spectrophotometer.
- **2.7: LC-MS:** About, principle, instrumentation, applications
- **2.8: Nuclear Magnetic Resonance Spectroscopy (NMR):** About, principle, instrumentation, techniques, applications**.**
- **2.9:** Thermodynamics: Basics of thermodynamics, laws of thermodynamics and living organism, entropy, enthalpy, Efficiency and free of energy system, concept of energy in biological system, chemical potential.
- **2.10**: Acid base equilibrium: Bronsted Lowry theory, proteolysis of water, hydrogen ion concentration, PH, Acid-base balance, Henderson and Hasselbalch equation**.**

Course No. NUD -402: Nutrition counseling and Sports Nutrition **4 Credits**

Group-A **2 Credits**

- **1.1: Nutrition Counseling:** definition, concept, the role of clinical dietician, the recipients, counseling environment. A systems approach to nutritional care: overview of the system, components of the system. Dietician as part of the medical team and outreach services
- **1.2: Factors for Counseling:** dietary diagnosis and tests for nutritional status – correlation, clinical and dietary information, nutritional and health conditions including cares of skin, hair, face, hands, feet etc. Psychological conditions, food allergies, aging, gender related and other problems. Aesthetic attributes of diets.
- **1.3: Assessment and planning component:** medical history assessment – techniques of obtaining relevant information for patient. Methods of interview – verbal and nonverbal techniques. Counseling models – data analysis (dietary, biological, environmental, behavioral data). Facilitator resource analysis – culmination of the assessment process. Designing of counseling plans – goals and objectives, classifying objections, resource planning – client care plan and designing evaluation instruments.
- **1.4: Implementation and evaluation component:** resources and aids of counseling the client/patient – client concurrence, co-ordination of care plans - the provision of learning experience. Measuring the success of performance of client and evaluating the counseling process. Pretest and Post test counselling, GATHER approach of counselling, Patient education and counseling – assessment of patient needs, establishing report, counseling relationship. Follow up visits and patient education, Ethics of counselling.
- **1.5: Nutrition Advocacy:** concepts and practices in nutrition advocacy – steps for success concept of mainstreaming nutrition in all child survival programs and in national health and development programs. National policies and nutrition advocacy – Nutrition Mission of various states.

Group-B **2 Credits**

- **2.1: Approaches to the management of fitness and health:** Nutrition, exercise, physical fitness and health - their interrelationship. Significance of physical fitness and nutrition in prevention and management of weight control regimes. Nutrition guidelines for maintenance of health and fitness.
- **2.2: Nutritional requirements of exercise:** Effect of specific nutrients on work performance and physical fitness. Nutrients that support physical activity, mobilization of fuel stores during exercise. Fluid requirements
- **2.3: Nutrition in sport activities:** Sports specific requirements- importance of carbohydrate loading, pre- game, post-game meals, diets for persons with high energy requirements, stress, fracture and injury
- **2.4: Dietary supplements and ergogenic aids:** Definitions, Use of different nutragenic / ergogenic aids and commercial supplements, sports drinks, sports bars etc.

Course No. NUD -403: Research Methodology, Review and Scientific Article writing skill
4 Credits

Group-A **2 Credits**

- **1.1:** Objectives of research: definition, objectives, types of research, quantitative and qualitative research in food and nutrition.
- **1.2:** Basic Principles of research design: Meaning and need, types of research designs – exploratory, descriptive, experimental, survey and case study - cross–sectional and longitudinal, Study design issues, sampling methods and sample size.
- **1.3:** Instruments of data collection; Observation, questionnaire, interview: reliability and validity of measuring instruments, data management and quality control
- **1.4:** Research Strategies in food and Nutrition: Issues in design, conduct, analysis and interpretation a) descriptive studies (case studies, case-control and cohort studies – prospective and retrospective)
- **1.5:** Ethics in nutrition research
- **1.6:** Pilot project and its importance.

Group- B **2 Credits**

- 2.1. Concept about project, Dissertation and Thesis- a) Different forms – research articles / notes, review articles, monographs, dissertations, and reports
  b) components of dissertation / research report / article c) Methods of presenting research findings – oral / poster

- 2.2. Quality of scientific Article writing
  a. Connotation, Denotation.
  b. Golden rules of Aricle Writing.

- 2.3. Review and Project paper writing- major heading and steps, background of Literature review, aims and objectives, Methodology, Expenditure, Bibliography of project proposal formulation, PERT chart.

- 2.4. Concept of Citation Index, Impact factor, I-10 Index, h Index.

- 2.5. Abstract writing- good criteria.

- 2.6. Discussion section- Quality improvement

- 2.7. data Presentation through graphics, Quality control.

Course NUD- 404: Nutrigenomics, Nutri proteomics and Drug Nutrient Interaction

4 Credits

Group-A **2Credits**

- **1.1:** Fundamentals of DND – structure and function
- **1.2:** Fundamental of genetic engineering
- **1.3:** Fundamental of PCR, RTPCR, and Q-PCR for gene expression
- **1.4:** Nutrient and Gene expression with special reference to vitamin and other macronutrient, Role of nutrient and dilatory component in regulation of genome structure expression and stability.
- **1.5:** Role of individual nutrient requirement on genetic variation,
- **1.6:** Idea about nutrigenomics. Nutrition is only one player in the epigenetic repertoire, Epigenetic effect of nutritional supplement to pregnant mother to regulate the undesirable gene expression of fetus like cancer, obesity and diabetes.
- **1.**7: Proteomics, Metabolomics in Nutrition- Principle, Process and application.

Group-B **2 Credits**

- **2.1: Drugs and pharmaceutical compounds-** natural and synthetic, use of excipients.
- **2.2: Characteristics of drugs action:** Pharmacodynamics, pharmacokinetics, route and form of excretion. Drug abuse and drug resistance
- **2.3: Drug-nutrient interaction**s – effect of drugs on ingestion, digestion, absorption and metabolism of nutrients, effect on nutritional status, effect on organ function, drug dosage and efficacy.
- **2.4: Nutrient effects on drug therapy –** effects of dietary composition, interactions between medication and milk, iron, fruit juices, antacids.
- **2.5:** Intestinal microflora and nutrition of hosts.
- **2.6:** Nutrients as medicine (Pharmacologic use of nutrients)

Practical

Course No. NUD- 495: Internship Training in Hospital & Report Preparation (1 month)
4 Credits

Internship

Students are required to perform internship in hospitals / foods service institutions / Clinics and they have to submit a report on the internship training during examination. Evaluation of internship shall be made on the basis of report and viva-voce examination.

Course No. NUD -496 : Project Work **4 Credits**

Project Work

(An independent research project work undertaken by student under the guidance of a teacher, can either be a survey or Laboratory oriented research. The research should be submitted at the end of session in the form of a dissertation. The project work can be undertaken at University departments, affiliated research institutions, quality control laboratories, food industries or other institutions with prior approval**)**

(The student should appear before examiners board and the dissertation shall be evaluated by means of presentation and viva - voce**)**

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